NASA's WEATHER ACCIDENT PREVENTION PROGRAM

A Look Back, and a Look Ahead - An Airline Perspective

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Where Were We - “Back Then”?

- “Datalink” meant ACARS...
  - Text – and S L O W
  - Approaching saturation
- XM and SIRIUS were riding high
  - Expected high revenue from audio channels
  - Not interested in ‘wasting’ bandwidth on data
- No in-flight weather graphics
  - Color *PRE-FLIGHT* WX graphics were a big innovation at most stations
  - Turbulence injuries were serious issue

Where Were We - “Back Then”?

- Pre- 9/11
  - Airline ‘boom’ was still in full swing
  - NAS capacity was our biggest problem
  - LCC’s were adding to capacity pressures, but were still mostly viewed as “upstarts”
  - Business cases were mainly based on capacity, delay reduction, and growth potential
  - Information support hadn’t really changed in 20 years
  - Security was not a central issue to safety

How Did Things Change?

- "Dot-Com" Meltdown
- Enron, Worldcom Collapse
- Economic Slowdown
- 9/11 Terrorist Attacks
- First NAS Shutdown in History
- Richard Reid Attempts Inflight Bombing
- Mombasa and Baghdad Missile Attacks
- Terrorism and Security Become Part of the Fabric of American Life – and Air Travel

How *ELSE* Did Things Change?

- Massive Airline Bankruptcies
  - Midway
  - USAir
  - Sun Country
  - United
  - USAirways
  - ATA
  - Delta
  - Northwest
  - …and counting…

How *ELSE* Did Things Change?

- The advent of –
  - TFR's
  - AvSP Becomes Safety and Security Program
  - Major Airport Security Increases
  - Massive Increase in Federal Air Marshalls
  - Federal Flight Deck Officer (FFDO) Program
  - Formation of Department of Homeland Security
  - Airline transition to a financially-driven business climate
  - Rapid Rise of LCC's to Industry-leading Role

Cabin Surveillance Phase 1 - Wireless Portable Display

UAL Counter-MANPADS Process

4. Missile is evaluated as valid threat to aircraft

5. CAPS automatically dispenses IR decoy

3. CAPS calculates missile range, velocity and time-to-go

6. IR decoy lures missile away from aircraft

2. CAPS determines if missile is a threat to the aircraft

7. CAPS performs effectiveness assessment
- Threat changes flight path?
- Closing velocity decreases?

1. CAPS searches for & automatically detects missile launch

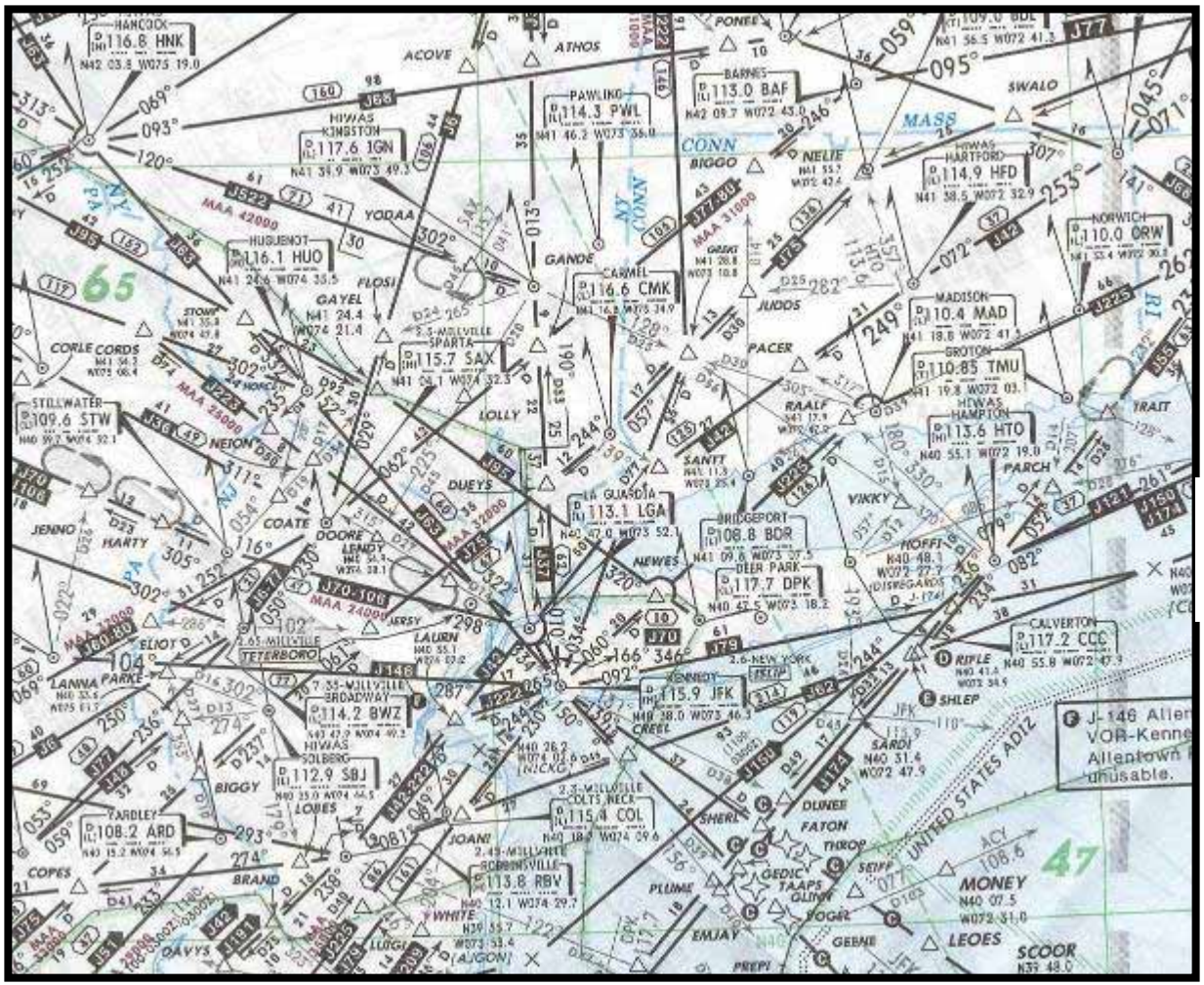
Multiple processes are continuously and simultaneously repeated to counter single and multiple MANPADS launches

Threat Successfully Countered!!

Proven, Effective, Reliable, Affordable

Terrorists in Position for Attack

Airspace Navigation Data Growth
FMS will not support 7% annual increase



2003

Did Anything *GOOD* Happen?

- Flight Deck Graphical Information - a Reality
  - Graphical Weather
    - Content, delivery, displays, human factors development
    - Practical Demonstrations – AWIN, WINN
    - Launch of FISDL and other commercial weather datalink services
    - Standards – RTCA SC195, AC 120-76/A
  - AHAS: Information instead of Data
  - Synthetic Vision
  - Surface Moving Map

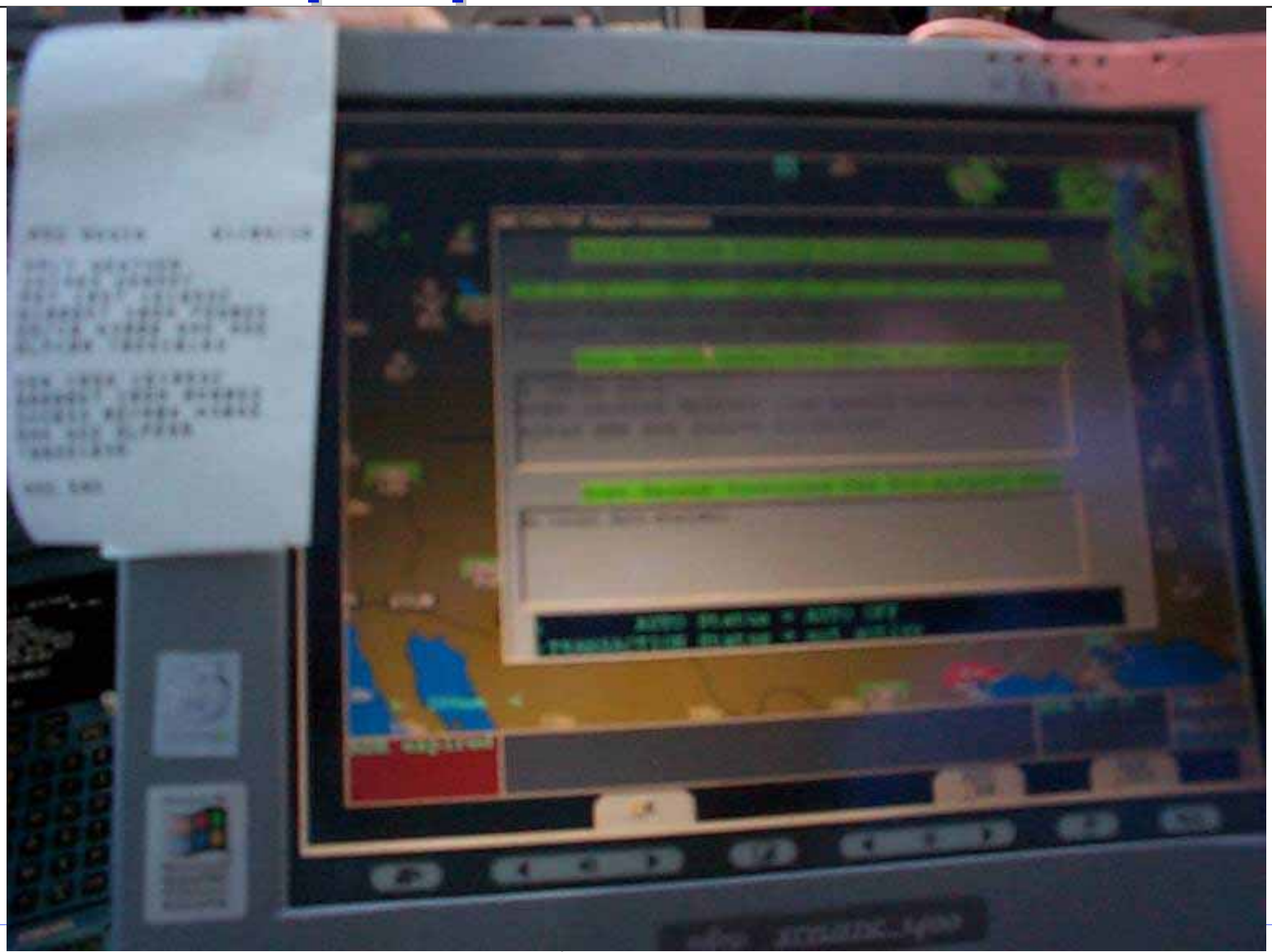
NASA AWIN –

United Airbus A320 with Honeywell WINN Graphical Datalink

Oklahoma Thunderstorm

Inside and Outside View

ACARS Paper print vs. EFB



Surface Moving Map

Captain Joe Burns Conducts First Actual Taxi Evaluation of United/FAA SMM at DEN

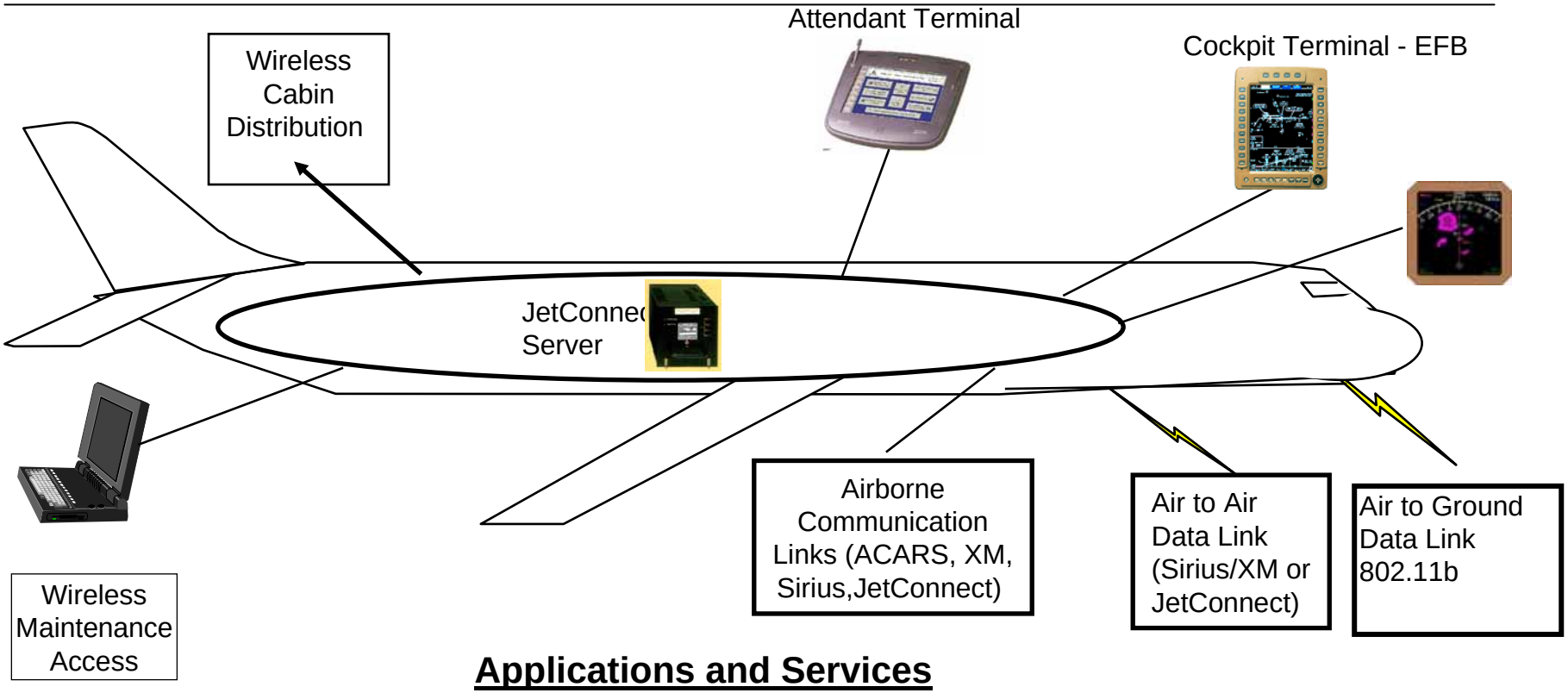
Any Other Good News?

- Widespread Automet Deployment
- Turbulence Mitigation
  - Enhanced Radar Turbulence Detection
  - Turbulence Measurement / Notification
  - Cabin Experiments – Turbulence Response
  - Wake Turbulence Research
- TAMDAR
  - Low-cost, Tropospheric Observations
  - Potential for Order-of-Magnitude Increase Over Automet Data

Any Other Good News?

- **NASA WINCOMM Initiative Brings Holistic Approach to "Datalink" Planning**
- **NASA and United RF Interference Research**
  - Helps define FCC UWB Spectral Mask
  - Provides basis for onboard WiFi certification
  - Provides basis for enhanced FAMS communication
  - Provides basis for cell phone use of taxi-in
- **XM/SIRIUS Reorganize, Embrace WX Delivery Business Case**
- **United Launches "AIRNET" Onboard Information Initiative**

Communications: Using Wireless in aircraft

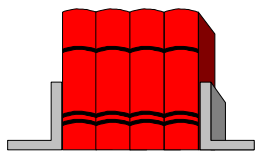


Applications and Services

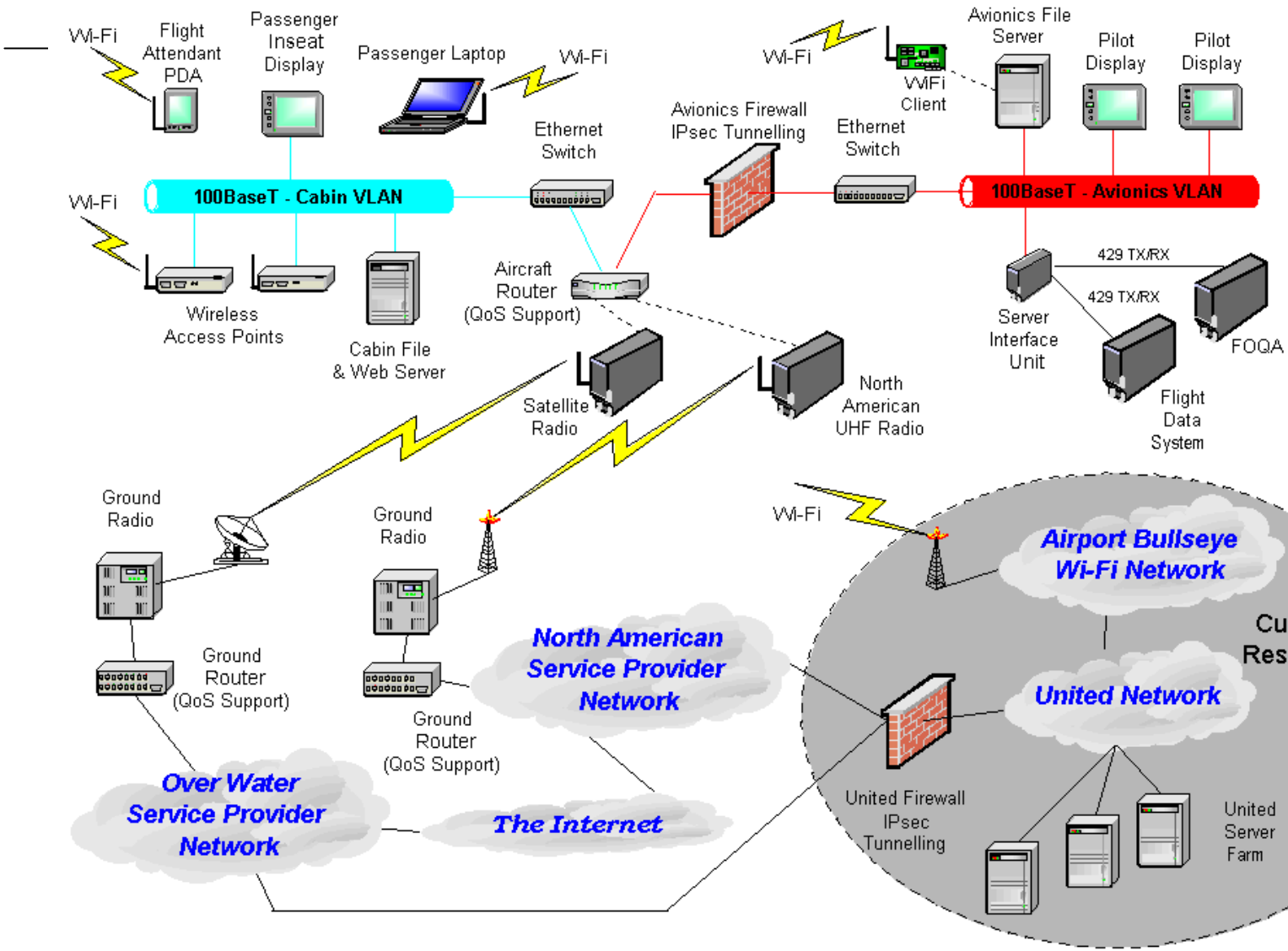
Flight Operations
- Weather
- Electronic Manuals/Charts
- Cabin Surveillance
- Surface Moving Maps
- Flight Papers/Data

Onboard/Passenger
- Rebooking/IRROPS
- Customer Profiles
- Buy On Board
- Live Audio
- Email/WAP Browsing

Maintenance
- *FIX
- Flight Data Downloads
- Electronic Logbook
- Maintenance Data Collection
- Electronic MEL



Air_Net Architecture



Where Do We Go From Here?

- **Turbulence Mitigation**
  - Interoperable metrics and methodology
  - Leverage in-place AUTOMET Platforms as much as possible
  - Low-cost AUTOMET RH Upgrade
  - Cabin Mitigation Options Development
  - Define and substantiate practical wake turbulence separation standards/practices
  - Development of wake vortex “zone of influence” graphics and delivery / display
  - Rigorous analysis of forward-looking LASER business case

Where Do We Go From Here?

- **Flight Deck Information Systems**
  - Business Case Research – build on previous Scanlon Study
- **TAMDAR**
  - Standards Development, Widespread Deployment / Data Integration
- **Communications**
  - Replace “built-to-purpose link” mentality with RCP
  - Develop “commercial aggregation” tools
    - Aggregate bandwidth to meet RCP
    - Aggregate “9’s” to meet RCP
    - Develop “pedigree overlay” for AOC, ATC functional RCP

COMMUNICATIONS:

What is the next domestic US Datalink for:

Aviation Weather
New AOC Path
Aircraft Data Updates
Security

Governmental Links:

- 8.33 domestic
- VDL/2
- VDL/3
- VDL/4
- CPDLC
- FANS/1A – FANS2
- Mode-S
- ADS-B – UAT/1090

Commercial links:

- Connexion
- Swift 64
- Iridium
- Orbcomm
- XM/Sirius
- Verizon Airfone
- Air Cell
- Aero 3G

Communications: ADLS/IP-Based Airborne Internet! (Required service level performance of all CNS)

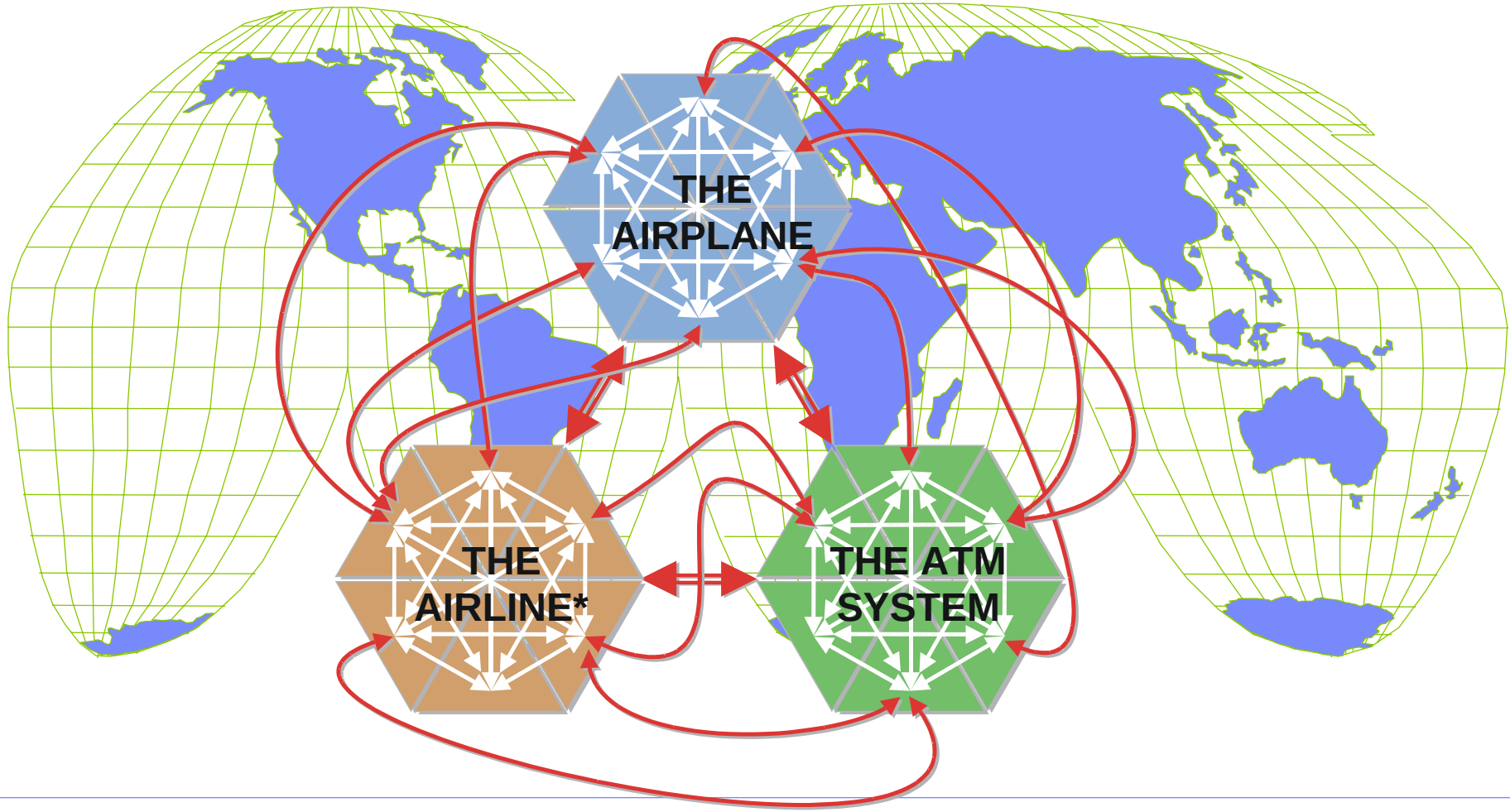
Governmental Links:

- ~~8.33 domestic~~
- ~~VDL/2~~
- ~~VDL/3~~
- ~~VDL/4~~
- ~~CPDLC~~
- FANS/1A – ~~FANS2~~
- ~~Mode-S~~
- ~~ADS-B – UAT/1090~~
- 25kHz VHF

Commercial links:
Connexion
Swift 64
Iridium
Orbcomm
XM/Sirius
Verizon Airfone
Air Cell
Aero 3G
Future COTS

Communication
for Truly Collaborative Decision Making

Each Constituent has Comparable Information – Accessed Via Multiple Paths Aggregated to Meet Mission Needs, Rather Than Link-to-Mission Design



Closing Thoughts

- **Safety Enhancements Must Pass Business Case Analysis To Be Widely Deployed**
  - Revenue or Operational Efficiency gains from safety systems will greatly speed adoption
  - Development of business case research data will lead to earlier, wider adoption

- **Security Still Matters**
  - Safety and Security are now nearly inseparable
  - Weather systems with security re-use will be deployed more widely and quickly

Thank You!

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